



## The Nu River: A Habitat in Danger

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The Nu River is an important freshwater ecological system in southwestern China. It boasts a wealth of fish species, more than 40 % of which are endemic to the region. The region is worth protecting for its immense value to biodiversity research. However, the number of fish species in the Nu has seen a sharp decrease in recent years, and big fish are found and caught much less often. Overfishing and ecological degradation have been cited as possible causes. With five cascading hydropower stations planned in the upper and middle reaches of the Nu, fish species in the Nu River now face alarming threats.

### Fish biodiversity in the Nu River Region

According to CHEN Xiaoyong's Fish Directory in Yunnan<sup>1</sup> and other recent research<sup>2</sup> conducted by his team, 62 species from 12 families of fish inhabit the Nu River, including 13 alien species. Among the 62 species, 20 are endemic (to the Nu, Yunnan province, or China), accounting for 40.8% of the local species - a high endemism proportion. See page 3 for a Nu River fish directory.

Seven fish species from the Nu are on Chinese and international lists of protected species: the *Anguilla nebulosi*, *Akrokolioplax bicornis*, *Placochelilus cryptonemus*, *Ptychobarbus kaznakovi*, *Gymnodiptychus integrigymnatus*, *Gagata dolichonema*, and *Danio browni*. In an effort to protect key species, the National Fisheries Genetic Resources Nature Reserve for Endemic Fish in the Upper and Middle Reaches of the

Nu River (NFRPA) was established in 2010, and approved by the Ministry of Agriculture. The protected area covers 316 km of the Nu's main stream and tributaries in the Nu Prefecture, where seven species have been chosen as key protected species, including *Schizothorax nukiangensis*, *Schizothorax gongshanensis*, *Tor hemispinus*, *Placochelilus cryptonemus*, *Anguilla nebulosi*, *Akrokolioplax bicornis*, and *Pareuchiloglanis gongshanensis*. Fifteen other species endemic to the Nu are also protected.

ZHENG Haitao conducted a preliminary analysis on the Index of Biological Integrity (IBI) of the fish species in the upper and middle reaches of the Nu in 2004. The result showed that the integrity of fish species in the area is in good condition with low human intervention. Constraints mainly come from natural elements, such as habitat type and food availability. The effects of human intervention are mainly visible in the Baoshan section of the Nu River.<sup>3</sup> However, Zheng predicts that in 10 years human intervention will exert much more influence on the environment.

### Threats to fish in the Nu River

In his research on the endangerment mechanism of fish in Yunnan river ecosystems, ZHOU Wei<sup>4</sup> argued that main threats to river fish

1 陈小勇.2013.云南鱼类名录.动物学研究.34(4):281-343

2 陈积颖.2015.怒江实地考察报告.

3 郑海涛.2006.怒江中上游鱼类生物完整性评价. 硕士论文

4 周伟. 云南湿地生态系统鱼类物种濒危机制初探. 2000. 生物多样性, 8 (2) : 163-168

come from water pollution, forest degradation, exhaustion of water resources, overfishing, and hydro development. Based on literature review, discussion with fish experts, and field research, we believe that the major threats to fish species in the Nu River are now overfishing and small hydropower stations on the river's tributaries.

After years of study, the Chinese Academy of Science's Kunming Institute of Zoology (CAS KIZ) has found that the number and size of fish in the Nu River are decreasing sharply. It used to be common for fishermen to catch *Schizothorax* of over 10 kg, estimated to be over 20 years old. Today, *Schizothorax* of that size cannot be found, and the number of *Schizothorax* has diminished. The CAS KIZ study attributes the problem to overfishing. While the average person in the Nu River region cannot afford to buy river fish, banquets for elites featuring river fish, bought with taxpayer money have encouraged local fishing. The Nu River is named for its raging torrent that prevents commercial fishing and limits fishers to small-scale hook and line fishing. However, fishers looking to make a profitable catch now enter the Nu River tributaries, where narrow and slow-moving currents allow for fishing by electrification and fish poisoning. These new methods cause harm to all fish species in the river basin.

The second threat is small hydro. Our field research has shown that small hydro on Nu tributaries has almost exceeded the river's capacity. Many river fish spawn in tributaries and juvenile fish swim back to main stream rivers after reaching adulthood. Scientists have yet to confirm which species in the Nu River possess such characteristics, but at this stage, it is already apparent that small hydro is directly related to the decrease of fish species in the Nu. Small hydro stations have destroyed Nu tributary habitats and spawning environments for migratory fish. Interruption to fish reproduction can cause a decrease in number and distinction. Destruction of fish habitats is a leading cause of decreasing fish biodiversity.

Large hydro stations are a main cause of the extinction of freshwater fish species in many parts of the world.<sup>5</sup> Likewise, dams planned on the upper and middle reaches of the Nu are major potential threats to Nu River fish species. The Nanjing Hydraulic Research Institute has conducted research<sup>6</sup> on the cumulative effects that cascade hydro development in the Nu on the ecological environment of the Nu River. Their study shows four cumulative effects.

First, hydro development impacts migratory fish. *Anguilla nebulosi* is the only mid- and long- distance migratory fish in the Nu, with a long migratory distance of 2,000 km. After spawning in the Indian Ocean, juvenile fish travel upriver as far as Bingzhongluo, and develop in the upper and middle reaches of the Nu. Short-distance migratory fish in the Nu River include *Bagarius yarrelli* and *Tetraodontidae*. If dams are built, they will cut migratory channels

5 Michel Slivitzky. A literature review on cumulative ecological impacts of water use and changes in levels and flows.

6 钟华平, 刘恒, 耿雷华. 怒江水电梯级开发的生态环境累积效应. 2008. 水电能源科学, 26 (1) : 52-59

and fragment habitats, discontinuing genetic communication and possibly causing the extinction of migratory fish in the Nu. The tragedy of the Yangtze River's *Acipenser sinensis* could be repeated in the Nu River.

Secondly, dams transform raging torrents into deep-water reservoirs, destroying habitats of fish species in the rapids. Third, discharged water has a lower temperature, so fish that favor higher water temperatures would be negatively affected. Fourth, water discharged from dams can cause an over-saturation of oxygen, affecting the health of the fish.

In analysis of current literature review on environmental and social effects of hydropower stations on the Lancang River, International Rivers found that hydro stations have had many negative consequences on the river and on the Lancang-Mekong river basin, including the blockage of migratory channels, fragmentation of habitats, and changes in aquatic ecological systems which cause changes in the number and composition of fish species in the river<sup>7</sup>. Meanwhile, species bred and introduced to the river after the development of the hydro stations have begun to crowd out endemic fish species.

The Mong Ton Hydro Station, 2,815 km from the China-Myanmar border, has the largest capacity planned on the Salween River. Scientists have pointed out that the project will kill 104 fish species, 80% of which are migratory<sup>8</sup>. Experts believe that the section of the Nu River south of Liuku contains fish species similar to those in rivers of Myanmar, due to the tropical climate and the long distances that fish travel. Due to lack of access to relevant scientific research in Myanmar, no data or information is currently available on the similarities with species in the lower reaches of the river. However, large hydro stations built in the upper or lower reaches will affect the fish resources available to downstream countries.

According to the *Liuku Hydropower Project Water Resources Demonstration Report*, the research conducted by CAS KIZ shows that there are 22 short-distance migratory fish species in the section north of Liuku. Many endemic and rare species inhabit this section, although the diversity is low. The most rare species is *Tor hemispinus*, which does not exist outside Liuku. The Liuku Hydropower Station is small, with a reservoir that follows the river way so that the hydrological situation remains largely the same and the effects on aquatic species are low, with no threat of species extinction. However, building a reservoir will slow the water flow down, which will affect species living in the rapids. It will also affect rare and endemic species, so protective measures must be taken to minimize the impact of engineering construction on fish resources.<sup>9</sup>

7 International Rivers. The Environmental and Social Impacts of Lancang Dams. 2014. <http://www.internationalrivers.org/resources/8390>

8 SMEC defends role in assessing Myanmar dam. 2015. <http://www.sbs.com.au/news/article/2015/08/04/smec-defends-role-assessing-myanmar-dam>

9 六库水电站工程水资源论证报告书.

We have also found that there is little research on Nu River fish. Current studies focus only on the identification of species without regard for fish ecology. There is even less research on fish species in the section of Nu River that flows through Tibet. The Tibetan Plateau has unique geographical characteristics, so it is possible that new species have yet to be discovered. So far, no research has analyzed the impacts of environment changes on fish in the Nu River. Current claims are mostly speculations based on the experience of experts.

### Suggestions for Future Protection

China has taken some protective measures, including CAS' establishment of a monitoring network for freshwater fish diversity in China.<sup>10</sup> There are three monitoring points for the Nu, namely Gongshan in the upper reaches, Liuku in the middle reaches, and Yongde in the lower reaches. CAS KIZ is in charge of implementation, with a focus on the representative species of

<sup>10</sup> 中国淡水鱼类生物多样性观测网络介绍. <http://www.brim.ac.cn/sites/default/files/download/150120huanzhangliu.pdf>

*Schizothorax*, *Sisorinae*, and *Cobitidae*.

There is a strong need for institutional research on Nu River fish ecology. Current research on the Nu is mostly limited to fauna composition, and ignores fish ecology and migratory characteristics. When discussing hydro projects' impacts on fish, current research fails to pose solutions that are based on sound scientific research and data.

The Chinese government should enhance its protection of the Nu River through legislation and enforcement. As a protected area with valuable fish resources, the National Fisheries Genetic Resources Nature Reserve for Endemic Fish in the Upper and Middle Reaches of the Nu River should serve as an ecological space to protect not only fish species in the Nu River mainstream, but also key water and terrestrial habitats for fish reproduction, including spawning grounds, feeding grounds, overwintering grounds, and migratory channels throughout the Nu River basin. Only when all these factors are taken into account will the freshwater ecological system of the Nu River be protected.

## YUNNAN NU RIVER FISH DIRECTORY

| Order          | Family        | Genus               | Latin Name                                       | Endemic             | Level of Protection   |
|----------------|---------------|---------------------|--|---------------------|---|
| Anguilliformes | Anguillidae   | Anguilla            | <i>Anguilla nebulosa</i>                         |                     | Level II, Yunnan Provincial Protected Animals<br>EN, CSRL<br>NT, IUCN |
| Cypriniformes  | Botiidae      | Botia               | <i>Botia histrionica</i>                         |                     |   |
|                | Cobitidae     | Lepidocephalichthys | <i>Lepidocephalichthys hasselti</i>              |                     |   |
|                |               | Misgurnus           | <i>Misgurnus anguillicaudatus</i> (Pond loach)   |                     |   |
|                | Balitoridae   | Hemimyzon           | <i>Hemimyzon nujiangensis</i>                    | Nu River            |   |
|                | Nemacheilidae | Homatula            | <i>Homatula pycnolepis</i>                       | Yunnan              |   |
|                |               | Pteronemacheilus    | <i>Pteronemacheilus meridionalis</i>             |                     |   |
|                |               | Schistura           | <i>Schistura disparizona</i>                     | Nu River            |   |
|                |               |                     | <i>Schistura longa</i>                           | Nu River            |   |
|                |               |                     | <i>Schistura poculi</i>                          |                     |   |
|                | Triphophysa   |                     | <i>Triphophysa brevicauda</i>                    |                     |   |
|                |               |                     | <i>Triphophysa nujiangensa</i>                   | Nu River            |   |
|                |               |                     | <i>Triphophysa stenura</i>                       |                     |   |
|                |               | Cyprinidae          | Danio  | <i>Danio browni</i> |   |
| Cypriniformes  | Cyprinidae    | Danio               | <i>Danio shanensis</i>                           | Nu River            |   |
|                |               | Barilius            | <i>Barilius caudocellatus</i>                    |                     |   |
|                |               | Aspidoparia         | <i>Aspidoparia morar</i>                         |                     |   |
|                |               | Megalobrama         | <i>Megalobrama amblycephala</i> (Wuchang bream)* |                     |   |
|                |               | Pseudorasbora       | <i>Pseudorasbora parva</i> (Stone moroko)*       |                     |   |

|              |             |                    |  |          |          |
|--------------|-------------|--------------------|--|----------|----------|
|              |             | Abbottina          | <i>Abbottina rivularis</i> *                       |          |          |
|              |             | Mylopharyngodon    | <i>Mylopharyngodon piceus</i> *                    |          |          |
|              |             | Ctenopharyngodon   | <i>Ctenopharyngodon idella (Grass carp)</i> *      |          |          |
|              |             | Hypophthalmichthys | <i>Hypophthalmichthys molitrix (Silver carp)</i> * |          |          |
|              |             |                    | <i>Hypophthalmichthys nobilis (Bighead carp)</i> * |          |          |
|              |             | Tor                | <i>Tor hemispinus</i>                              | Nu River |          |
|              |             | Neolissochilus     | <i>Neolissochilus baoshanensis</i>                 | Yunnan   |          |
|              |             | Onychostoma        | <i>Onychostoma gerlachi</i>                        |          | NT, IUCN |
|              |             | Scaphiodonichthys  | <i>Scaphiodonichthys acanthopterus</i>             |          |          |
|              |             | Poropuntius        | <i>Poropuntius opisthopterus</i>                   | Nu River |          |
|              |             | Percocypris        | <i>Percocypris retrodorslis</i>                    | Yunnan   |          |
|              |             | Crossocheilus      | <i>Crossocheilus burmanicus</i>                    |          |          |
|              |             | Gonorhynchus       | <i>Akrokolioplax bicornis (Bihorned barbel)</i>    | Nu River | EN, CSRL |
|              |             | Garra              | <i>Garra nujiangensis</i>                          | Nu River |          |
|              |             |                    | <i>Garra salweenica</i>                            |          |          |
|              |             | Placocheilus       | <i>Placocheilus cryptonemus</i>                    | Nu River | VU, CSRL |
|              |             | Schizothorax       | <i>Schizothorax gongshanensis</i>                  | Nu River |          |
|              |             |                    | <i>Schizothorax lissolabiatus</i>                  | China    |          |
|              |             |                    | <i>Schizothorax nukiangensis</i>                   | Nu River |          |
|              |             |                    | <i>Schizothorax yunnanensis paoshanensis</i>       | Nu River |          |
|              |             | Gymnodiptychus     | <i>Gymnodiptychus integrigymnatus</i>              | Yunnan   | CR, CSRL |
|              |             | Cyprinus           | <i>Cyprinus carpio (Common carp)</i> *             |          |          |
|              |             | Carassius          | <i>Carassius auratus (Goldfish)</i> *              |          |          |
| Siluriformes | Clariidae   | Clarias            | <i>Clarias fuscus</i>                              |          |          |
|              |             |                    | <i>Clarias gariepinus</i> *                        |          |          |
|              | Ailiidae    | Clupisoma          | <i>Clupisoma yunnanensis</i>                       | Nu River |          |
|              | Ictaluridae | Ictalurus          | <i>Ictalurus punctatus (Channel catfish)</i> *     |          |          |
|              | Sisorinae   | Bagarius           | <i>Bagarius yarrelli (Giant devil catfish)</i>     |          | NT, IUCN |
|              |             | Gagata             | <i>Gagata dolichonema</i>                          |          | VU, CSRL |
|              |             | Glyptothorax       | <i>Glyptothorax burmanicus</i>                     |          |          |
|              |             |                    | <i>Glyptothorax granosus</i>                       | Nu River |          |
|              |             |                    | <i>Glyptothorax lanceatus</i>                      | Nu River |          |
|              |             |                    | <i>Glyptothorax longinema</i>                      |          |          |
|              |             |                    | <i>Glyptothorax ngapang</i>                        |          |          |
|              |             |                    | <i>Glyptothorax trilineatus</i>                    |          |          |
|              |             |                    | <i>Glyptothorax zanaensis</i>                      | Nu River |          |
|              |             | Pseudecheneis      | <i>Pseudecheneis longipectoralis</i>               | Nu River |          |
|              |             | Creteuchiloglanis  | <i>Creteuchiloglanis gongshanensis</i>             |          |          |
|              |             |                    | <i>Creteuchiloglanis macropterus</i>               |          |          |
|              |             | Pseudoexostoma     | <i>Pseudoexostoma brachysoma</i>                   | Nu River |          |
| Perciformes  | Cichlidae   | Oreochromis        | <i>Oreochromis mossambica</i>                      |          |          |
|              |             |                    | <i>Oreochromis nilotica</i>                        |          |          |
|              | Channidae   | Channa             | <i>Channa gachua Dwarf snakehead</i>               |          |          |

(\* Alien Species; CSRL=China Species Red List)

(Data Source: CHEN Zhiying, Field Research Report, October 2015)

Front photo: The first bend of the Nu River